Work - Energy Quiz Monday, Jan 22nd

Gravitational energy, E_g (book E_p for potential energy)

$E_g = mgh$

m is the mass, in kg

g is gravitational field strength, 9.80N/kg

h is height from a reference point, in m

- usually you set the reference at lowest point.

energy is conserved, it changes from one form to another.

eg. when you roll down a hill, gravitational energy is transformed into kinetic energy and some thermal energy (friction).

eg. a pokemon ball rolls down a 5.0m high hill. If the ball is 0.500kg, what is

a) the gravitational energy at the top of the hill
b) if the ball is moving at 2.0 m/s at the top of the hill, what is the kinetic energy and total energy of the ball?
c) if no energy is lost due to friction, what would be the speed of the ball at the bottom of the hill?
d) if the speed at the bottom of the hill is 9.0 m/s,

how much energy was lost to frictional or rotational energies?

p224-230 Q5-12, CR 1.1-1.5
(we will go over CR 2.1-2.4 from the homework p 211 later in the class)

http://techtv.mit.edu/videos/1491-potential-energy-to-kinetic-energy

https://www.youtube.com/watch?v=BVxEEn3w688&feature=fvw

a) Eg = mgh = 0.5x9.8x5=24.5 J
kgxN/kgxm = Nm = J
b) Ek = 1/2 mv^2 = 0.5x0.5x2x2=1.0J
E_{total} = Eg+Ek = 24.5+1=25.5 J
c) big idea: energy is conserved, so
total energy initial = total energy final
25.5J = Ek = $1/2mv^2$
v = Sqrt(2x25.5/0.5)=10.09950493836208
v = 10m/s
d) total energy initial = total energy final
Egi + Eki = Ekf+E_{lost} (Eg is zero at the bottom, that is where you set h=0)

25.5J = 0.5x0.5x(9^2) + Elost
Elost = 25.5-(0.5x0.5x(9^2))=5.25 J lost to

25.5J = 0.5x0.5x(9^2) + Elost
Elost = 25.5-(0.5x0.5x(9^2))=5.25 J lost to frictional or rotational effects

https://www.youtube.com/watch?v=PplaBASQ_3M

Work - Energy Quiz Monday, Jan 22nd
Double block day - rocket lab south field - bring boots/rain stuff - group of 3-5
test - end of the next week - Feb 2nd ?

Gravitational energy and conservation of energy.

Last class - work energy theorem -

W=change in energy

used to derive the equation for kinetic energy

$E_k = 1/2mv^2$

We do the same thing for gravitational energy

$W_g = \Delta E_g$
work done against gravity = the change in

gravitational energy

W= Fd

$W_g = F_g d = mgd = \Delta E_g$

d is the displacement up/down, = change in height

$mg\Delta h = \Delta E_g$

thus

$E_g = mgh$

E_g is the gravitational energy, in Joules, J.

m is the mass, in kg

g is gravitational field strength, 9.8N/kg near Earth.

h is the height relative to a reference point, in m usually you choose the lowest point as the reference point.

Big Idea - Energy is conserved

Total of all the types of energy initial = total of all the types of energy final

$E_{total\ i} = E_{total\ f}$

eg. A 2.0 kg tire rolls down a 5.0 m high hill.

What is the

a) initial gravitational energy of the tire?

Eg = mgh = 2.0 kg x 9.8N/kg x 5.0 m = 98J

a) if the tire starts out moving at 4.0 m/s, what is the initial kinetic energy of the tire?

Ek = 1/2 mv^2 = 0.5 x 2.0kg x (4m/s)^2 = 16 J

a) What is the total initial energy of the tire?

Etotal = Eg+Ek = 98+16=114 J

a) if all the energy of the tire goes to kinetic energy as it rolls down the hill, how fast is it going at the bottom?

Etotal = Ek = 1/2 mv^2

v= Square root (2xEk/m)

v = Sqrt(2x114/2)=10.6770782520313

v= 11m/s

a) if the speed of the tire at the bottom of the hill is only 9.0 m/s, how much energy was lost to friction or rotational effects?

Etotal i = Etotal f

114J = Ek + Elost (Eg = 0 at lowest point)

114J = 0.5x2x(9^2) + Elost

Elost = 114-(0.5x2x(9^2))=33 J

p224-230 Q5-12 CR 1.1-1.5